SIEMENS

ARCADIS Avantic

SP

Quality Assurance

System

Image Quality Quick Test

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Print No.: SPR2-330.820.01.02.02
Replaces: SPR2-330.820.01.01.02

English
Doc. Gen. Date: 12.05

Document revision level

The document corresponds to the version/revision level effective at the time of system delivery. Revisions to hardcopy documentation are not automatically distributed.

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NOTICE

When performing the work and tests described in the following, observe the product-specific safety information as well as the general safety information contained in TD00-000.860.01.

➪ **n.a.**

Notes and symbols

The signal words are used and classified in anticipation of the new Medical Solutions CS standard which is based on ANSI standard Z535.4.

Text emphasized in technical documentation has the following meaning:

⚠ **DANGER**	**DANGER indicates when there is an immediate danger that l e a d s to death or serious physical injury.**
⚠ **WARNING**	**WARNING indicates a risk of danger that m a y l e a d to death or serious physical injury.**
⚠ **CAUTION**	**CAUTION used with the safety alert symbol indicates a risk of danger that leads to slight or moderate physical injury and/ or damage to property.**
NOTICE	**NOTICE used without the safety alert symbol indicates a risk of danger that if disregarded leads or may lead to a potential situation which may result in an undesirable result or state other than death, physical injury or property damage.**

Fig. 1: Safety Notes

System identification

Material no.: _____ Serial no.: _____
Customer/clinic: _____
Address: _____ City: _____
State/province: _____ Country: _____
Phone no.: _____ Contact person: _____
System no.: _____ Office: _____
Responsible system engineer: _____

System configuration:

33 cm I.I. ❒

Image quality acceptance in the factory performed completely and documented by:

Name (block letters): _____ Dept.: _____
Signature: _____ Date: _____

Customer installation date: _____

IQ quick test performed at:

Transfer to the customer during maintenance ❒

Settings deviating from the standard based on:

Country-specific regulations ❒ Spec. customer wishes ❒

Reason _____
_____

Name (block letters): _____ Office: _____

Signature: _____

Required measuring equipment and tools

• Set of X-ray filters, 10 x 0.3 mm Cu		44 06 120 RV090
• Precision X-ray filter, 2.1 mm Cu		99 00 598 XE999
• 25 mm AL measuring stand, type 26765 acc. to DIN 6868 Part 50 or 1.2 mm Cu from the X-ray filter set 17 µm Cu strips		97 98 596 G5321 and 11 67 662 G5247
• Resolution test set type 41		28 71 820 RE999
• Densitometer	e.g. X-Rite 331 or PTW-BC21 including black check Type 5321 and light box type 53213	97 02 416 Y1996
• Dynamic test case		37 90 156 X1963
	or	97 50 001 X1963
containing:	TV dynamic test	37 90 164 X1963
	Heart contour diaphragm	37 90 172 X1963
	Capillary test	37 90 180 X1963
	Bracket	87 13 901 X1963
	Veiling glare test	87 09 743 X1963
• SMfit Spotmeter		77 52 848

Requirements

Basic measuring conditions

- Completely functioning system; ensure that
  - Grid,
  - Tube assembly with collimator and 2.1 mm Cu are installed.
- Dose rate (I.I. input) of the "standard dose" level in FLUORO means: (full format; setting tolerance + 15 %). Dose rate (I.I. input) of the "standard dose" level in DR means: (full format; setting tolerance + 15 %).

33 cm I.I.: 0.131 µGy/s - fluoro

- The setpoints listed in the following chapters apply for a "medium" dose level; in the case of deviating settings, setpoints may have to be adapted.
- When requested to switch
  - Noise reduction K-factor
  - Edge
  - Motion detection
  - Fluoroscopic characteristic
  - Or other parameters in the organ programs, select or change a correspondingly predefined organ program or, if possible, change the parameter directly in the examination task card.

NOTE	**Use only the program stated in the IQ test. Deviations are pointed out explicitly.**

NOTE	**Perform only in the factory.**

Checking the monitors

- To load the test images on the ASPIA live monitor, call up the following items under Options in the sequence stated:
- Call up local service.
- Load test images.

  Call up **patient**→ **patient list** → **local database**→ **service patient**→ **test images**→ and load **test images**.
- All gray scale values must be clearly visible on the monitor, especially the 5% and 95% fields. (Select the test image via the scroll bar, see next page).
- Then measure the 100% (white) and 0% (black) fields with the SMfit Spotmeter.
- Check the brightness of the monitors and adjust it if necessary.
- The maximum permissible difference between the two monitors is +10/-10 cd/m^2 .
- **Eizo color monitor and SIEMENS color monitor DSC 1904-D:**
  - Luminance setpoint: 200 +20/-20 cd/m^2 in the delivery state.
  - The monitor is worn out when the maximum adjustable luminance is less than **120** cd/m^2.
- **BARCO monochrome monitor:**
  - Luminance setpoint: 410 +20/-20 cd/m^2 in the delivery state.
  - The monitor is worn out when the maximum adjustable luminance is less than **350** cd/m^2.

Monitor type	**Luminance in cd/m^2**		**Ambient light sensor* active**	**Comments**
	0% field	100% field		
18" TFT (Eizo)	< 1	≥ 200 +20/-80	n.a.	*1, *2,
19” TFT DSC 1904-D	0,8 ±0,2	≥ 200 +20/-80	n.a.	*1, *2,
18"B/W TFT (BARCO mon.)	0,9 ±0,1	≥ 410 +20/-60	No	*1, *2, *3
*When shipped, the ambient light sensor is deactivated.				

Remarks:

*1 Setting with 100% field with backlight.

*2 The 5% and 95% fields must be visible. Setting: 5% with brightness control. Setting: 95% with contrast control.

*3 B/W TFT monitors are set with the ambient light sensor deactivated.

Setting of the 0% field brightness.

Setting of the 100% field with backlight.

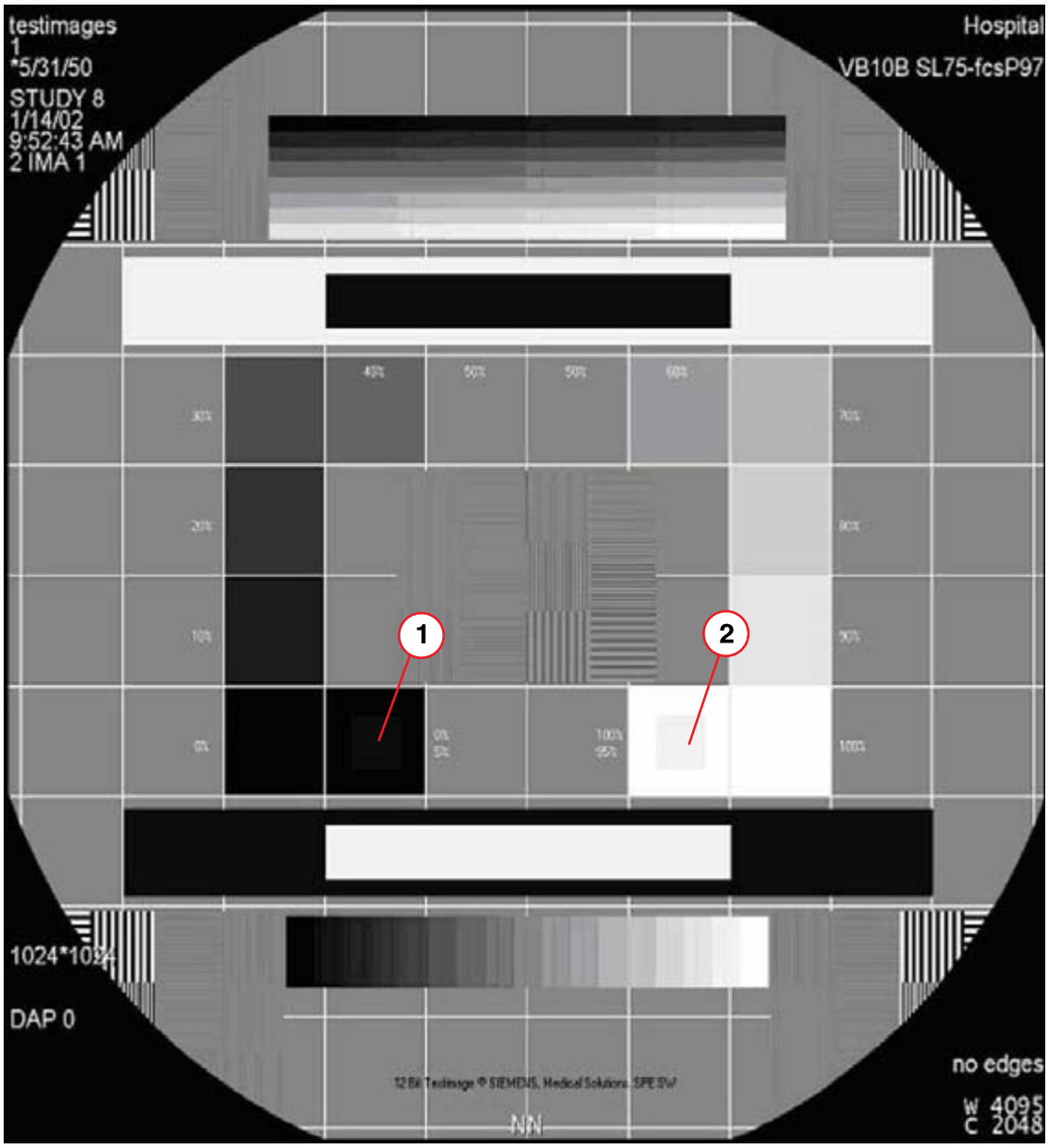

Fig. 2: SMPTE image (positive) bones black display

Pos. 1 5% field

Pos. 2 95% field

Avantic tableside control (overview)

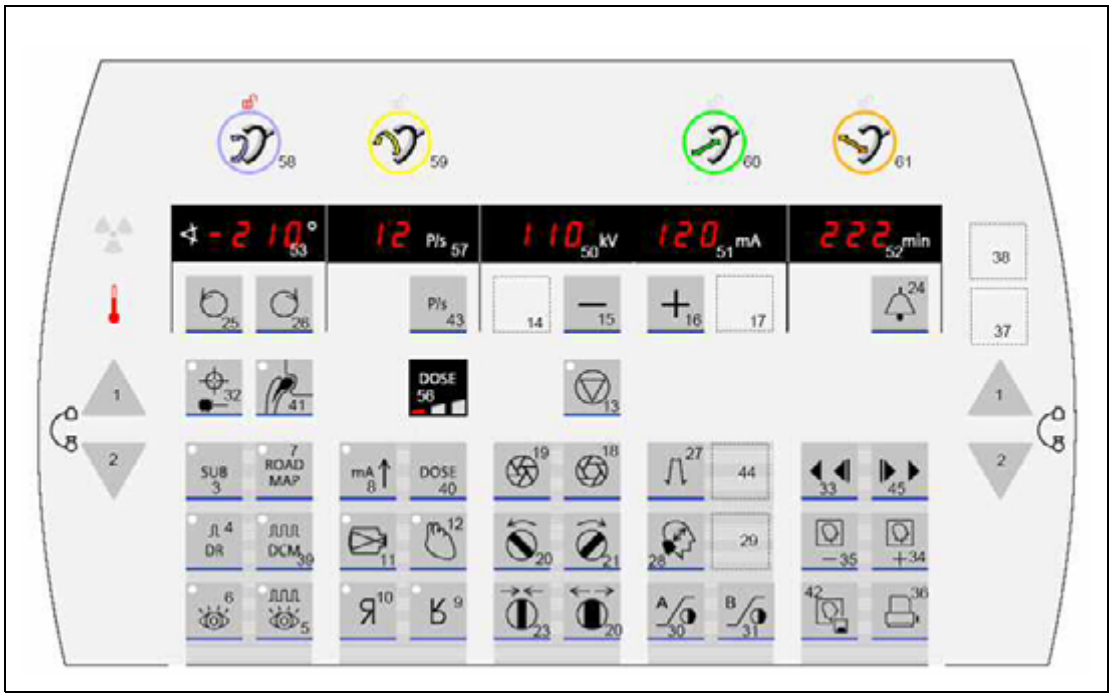

Fig. 3: Overview of button assignment on the control panel

Control panel buttons:

Button no.	Function
1	Move each column up two times
2	Move each column down two times
3	Subtraction mode "SUB"
4	Digital radiography mode "DR"
5	Pulsed fluoroscopy mode "pulsed FLUORO"
6	Fluoroscopy mode "FLUORO"
7	Roadmap mode
8	Push button
9	Top/bottom image reversal (vertical)
10	Left/right image reversal (horizontal)
11	Image intensifier zoom
12	Noise reduction (K-factor selection)
13	kV regulation stop
14	Reserve 1

15	kV/mA adjustment (-)
16	kV/mA adjustment (+)
17	Reserve 2
18	Open X iris diaphragm
19	Close X iris diaphragm
20	Rotate filter diaphragms CCW
21	Rotate filter diaphragms CW
22	Open filter diaphragm
23	Close filter diaphragm
24	Reset fluoro buzzer; set fluoro clock to zero
25	Left image token
26	Right image token
27	Edge enhancement
28	Electronic zoom in the memory
29	Reserve 3
30	Look-up-table for Monitor A
31	Look-up-table for Monitor B
32	Laser
33	Scene backward/stop
34	Scroll forward in the image memory
35	Scroll backward in the image memory
36	Initiate the documentation unit
37	n.a.
38	n.a.
39	DCM mode
40	Dose button
41	Metal button
42	Save image
43	Pulses per second
44	Reserve 4
45	Scene forward/stop

Brake control buttons

No.	Function
58	Orbital C-arm brake
59	Angular C-arm brake
60	Horizontal C-arm brake
61	Swivel C-arm brake

Requirements

- The standard settings are programmed for fluoroscopy, pulsed fluoroscopy and DR.
- Attach the 2.1 mm Cu precision X-ray filter in the area of the radiation port for prefiltration. Select "Medium dose" for the dose setting but select "High dose" for the DCM mode.

Evaluation

NOTE

Check the programmed default organ programs. If other ADR control characteristics are to be programmed at the customer's request, first check the programmed default characteristics.

ADR control characteristics for the fluoroscopy mode

- Select FLUORO program 1 (see table 1) medium dose.
- Select I.I. full format.

- Radiation on.
- Read off the kV and mA values displayed on the monitor.
- Radiation off.
- Enter the values in table 1.
- Select FLUORO program 2 (see table 1).
- Select I.I. full format.

- Radiation on.
- Read off the kV and mA values displayed on the control panel.
- Radiation off.
- The actual values documented in the factory must be obtained again at the place of use. Admissible deviations: Tube voltage (kV) ± 1 kV, tube current (mA) ± 10%.

Tab. 1

	Program sequence	**ADR control characteristics (included in program)**	**Setpoints**		**Actual values**			
					Factory		**Place of use**	
			kV	mA	kV	mA	kV	mA
1	Ortho Leg	S2	66 - 72	1,0 - 1,2				
2	Ortho Hip	HC 2	62 - 64	2.5 - 3.7				

ADR control characteristics for the pulsed fluoroscopy mode

- Select pulsed FLUORO, programs 1 and 2 (see table 2).
- For DCM (Option) pulse frequency see table 2 / select "High Dose" (Program 3).
- Select I.I. full format.
- Radiation on.
- Read off the kV and mA values displayed on the control panel.
- Radiation off. Enter the values in table 2.

Admissible deviations: Tube voltage (kV) ± 1 kV, tube current (mA) ± 10%.

Tab. 2

	Program sequence	**ADR control characteristics, pulsed fluoroscopy (included in program)**	**Setpoints**		**Actual values**			
					Factory		Place of use	
			kV	mA	kV	mA		
1	Ortho Leg	S2 / 7.5B/s Medium dose	64 - 70	14,3 - 18,6				
2	Ortho Hip	HC2 / 7.5B/s Medium dose	60 - 63	36,0 - 56,3				
3	Ortho, hip DCM (optional)	HC2 / 7.5B/s High dose	65-69	173-250				

ADR control characteristics for the DR mode

- Select the DR program (see table 3).
- Select I.I. full format.
- Radiation on.
- Read off the kV and mAs values displayed on the control panel.
- Radiation off.
- Enter the values in table 3.
- The actual values documented in the factory must be obtained again at the place of use. Admissible deviations: Tube voltage (kV) ± 1 kV, tube current (mA) ± 10%.

Tab. 3

Program sequence	**DR takeover** **DR characteris-tics**	**Setpoints**		**Actual values**			
Ortho				**Factory**		**Place of use**	
Hip		kV	mA	kV	mA	kV	mA
DR 1000 W	Medium dose "Cardiac button" off	62-65	4.2 - 6.8				

Checking the image position

Requirement

Place a long, thin, straight object (e.g. wire solder bent straight) near the I.I. - at an exact right angle to the C-arm orientation.

Place a second object next to it - for direction determination (see (Fig. 4 / p. 19)).

Fig. 4: Image position
Pos. 1 C_arm_alignment

The rotation angle of the image on the display of the basic unit must be 0.

If necessary, set the angle to 0.

Record an image (see (Fig. 5 / p. 20)).

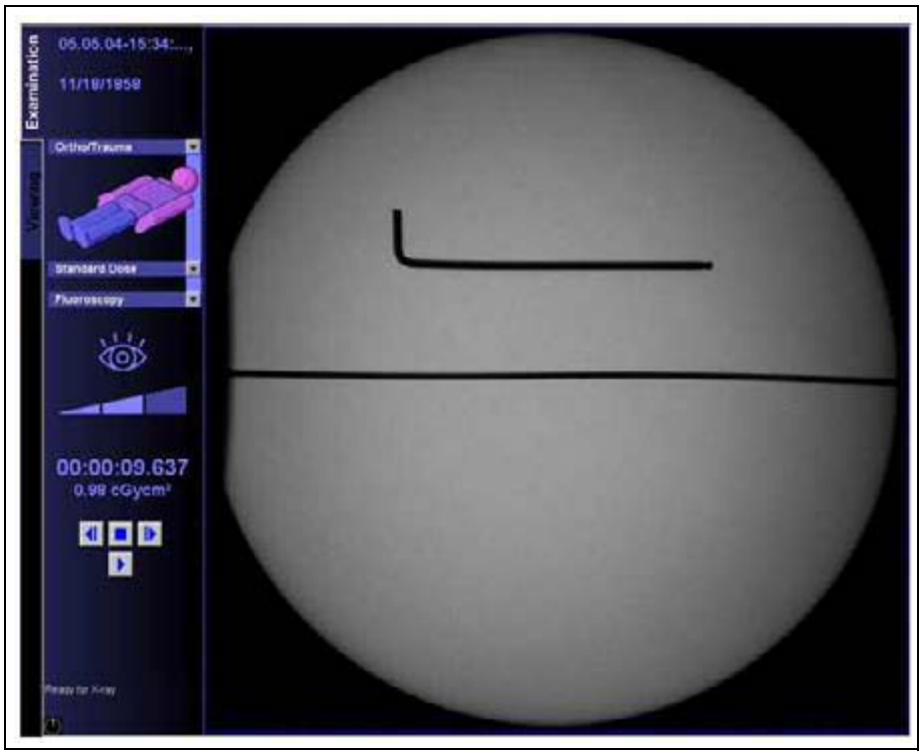

Fig. 5: Results image

Evaluation

The object must appear on the screen in an exactly horizontal position.

	Factory				Place of use				
Image position OK?	❒	Yes	❒	No		❒	Yes	❒	No

Checking the resolution and minimum contrast

Requirements

- Use resolution test type 41 (factory and place of use).
- Set the edge enhancement to optimum resolution.
- Attach the resolution test directly to the I.I. grid in the center of the I.I. at an angle of approx. 45 degrees to the grid lines.
- In the factory: Place a 25 mm AL measuring stand on the I.I.
- Place of use: If the 25 mm AL measuring stand (with 0.4 mm recess) is available, attach it near the I.I., otherwise attach the 17 µm Cu strip directly to the I.I. grid next to the resolution test. Additionally place a 1.2 mm Cu filter in the beam path. Fading at the I.I. edge can be eliminated via collimation.
- Select an organ program (see table (Tab. 4 / p. 22)), medium dose.

- Radiation "on".
- Set the monitor contrast to optimum resolution.
- Set the edge enhancement to optimum resolution.
  - You can select the electronic zoom function and windowing in the viewer mask
- Radiation "OFF", determine the resolution of the LIH image and enter it in table (Tab. 4 / p. 22).

NOTE

If necessary, use the electronic zoom function and windowing in the viewer.

Tab. 4 Resolution and minimum contrast table

Operating mode	I.I. format	Setpoints for resolution [lp/mm]	Actual resolution values [lp/mm]			
			Factory		Place of use	
		33 cm I.I.	Monitor 1	Monitor 2	Monitor 1	Monitor 2
FLUORO (HC2) Ortho, hip	Full format	≥ 1.4		n.a.		n.a.
FLUORO (HC2) Ortho, hip	Zoom 1	≥ 1.8		n.a.		n.a.
FLUORO (HC2) Ortho, hip	Zoom 2	≥ 2.2		n.a.		n.a.
FLUORO (HC2) Ortho, hip	Zoom 3	≥ 2.5		n.a.		n.a.
DCM (HC2) Ortho, hip	Full format	≥ 1.2		n.a.		n.a.
DCM (HC2) Ortho, hip	Zoom 1	≥ 1.6		n.a.		n.a.
DCM (HC2) (Ortho, hip, medium dose)	Zoom 2	≥ 2.0		n.a.		n.a.
DCM (HC2) (Ortho, hip, medium dose)	Zoom 3	≥ 2.2		n.a.		n.a.
DR (1000 W) (Ortho, hip, medium dose)	Full format	≥ 1.4		n.a.		n.a.

Operating mode	I.I. format	Setpoints for resolution [lp/mm]	Actual resolution values [lp/mm]			
			Factory		Place of use	
		33 cm I.I.	Monitor 1	Monitor 2	Monitor 1	Monitor 2
DR (1000 W) (Ortho, hip, medium dose)	Zoom 1	≥ 1.8		n.a.		n.a.
DR (1000 W) (Ortho, hip, medium dose)	Zoom 2	≥ 2.2		n.a.		n.a.
DR (1000 W) (Ortho, hip, medium dose)	Zoom 3	≥ 2.5		n.a.		n.a.

Minimum contrast perceptible?

Factory					Place of use				
Full format	❑	Yes	❑	No	Full format	❑	Yes	❑	No
Zoom 1	❑	Yes	❑	No	Zoom 1	❑	Yes	❑	No
Zoom 2	❑	Yes	❑	No	Zoom 2	❑	Yes	❑	No
Zoom 3	❑	Yes	❑	No	Zoom 3	❑	Yes	❑	No

- Then remove the 25 mm Al or 1.2 mm Cu prefilter.
- Collimate to the resolution test.
- Perform the resolution test for DR again without prefilter as above:

Evaluation

Tab. 5

Operating mode (Organ program)	I.I. format	**Setpoints** **for resolution [lp/mm]**	**Actual resolution values [lp/mm]** **Factory**	**Place of use**
		I.I. 33	Monitor 1	
DR (1000W) (Ortho, hip, medium dose)	Full format	≥ 1.6		
DR (1000W) (Ortho, hip, medium dose)	Zoom 1	≥ 2.0		
DR (1000W) (Ortho, hip, medium dose)	Zoom 2	≥ 2.5		
DR (1000W) (Ortho, hip, medium dose)	Zoom 3	≥ 3.1		

Dynamic test

NOTE

The dynamic test in conjunction with the plexi capillary test is used to detect small contrast differences.

- **Measuring setup:**
  - Remove the 1.2 mm precision X-ray filter from the beam path
  - Attach the dynamic test without holder but with heart contour diaphragm and plexi capillary test right in front of the I.I. input (plexi capillaries close to I.I.), see (Fig. 6 / p. 26).
- **Prerequisites:**
  - Organ program (general, hip, high dose).
  - Select full format. Select the I.I. distance from the dynamic test such that the image field is completely covered. If not possible, collimate to the I.I.
  - Select high noise reduction (cardiac button "off") on the control console.
  - Edge enhancement (button ⏀) off. Select “LUT Linear”.
  - Switch on radiation and evaluate the Plexi capillaries in the live image.

- **Evaluation of the monitor image**
  - **Setpoint**

    The plexi capillaries not identified in (Fig. 7 / p. 26) must be visible.
- Check off non-visible plexi capillaries in (Fig. 7 / p. 26) (from left to right 2L→1→5R.

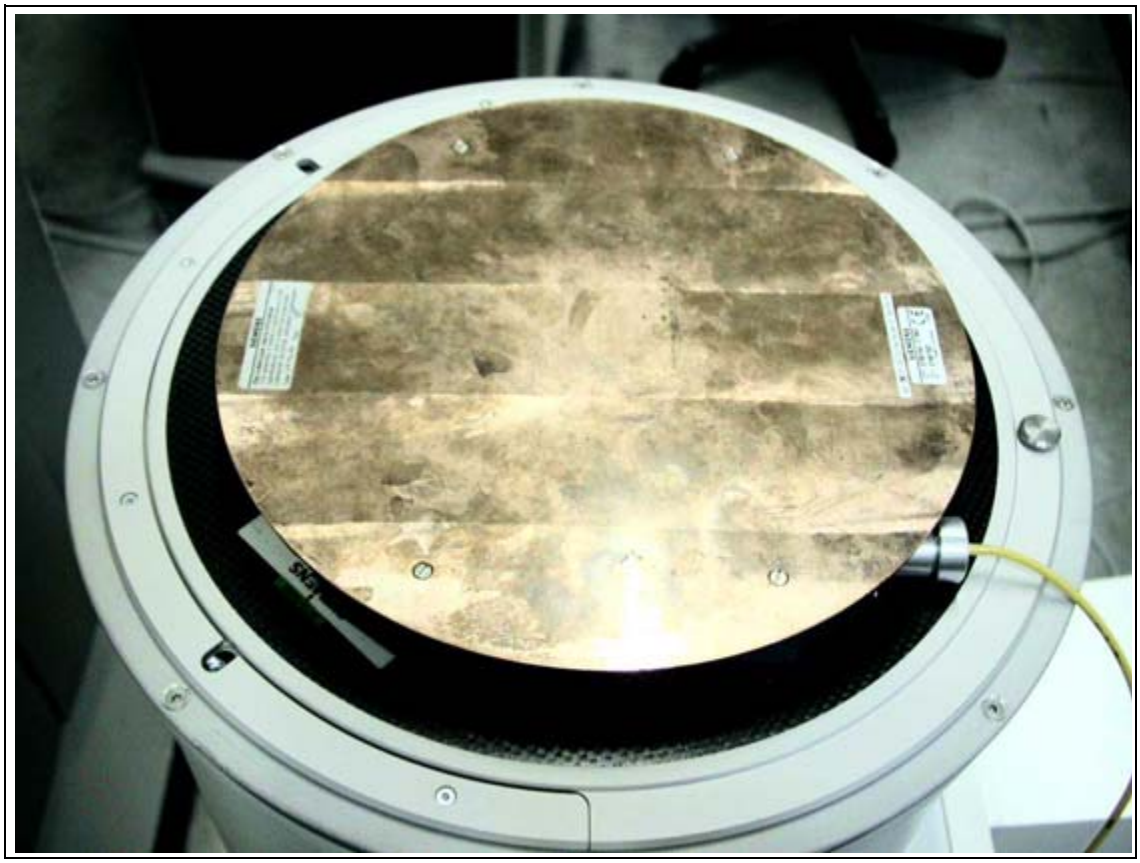

Fig. 6: Test

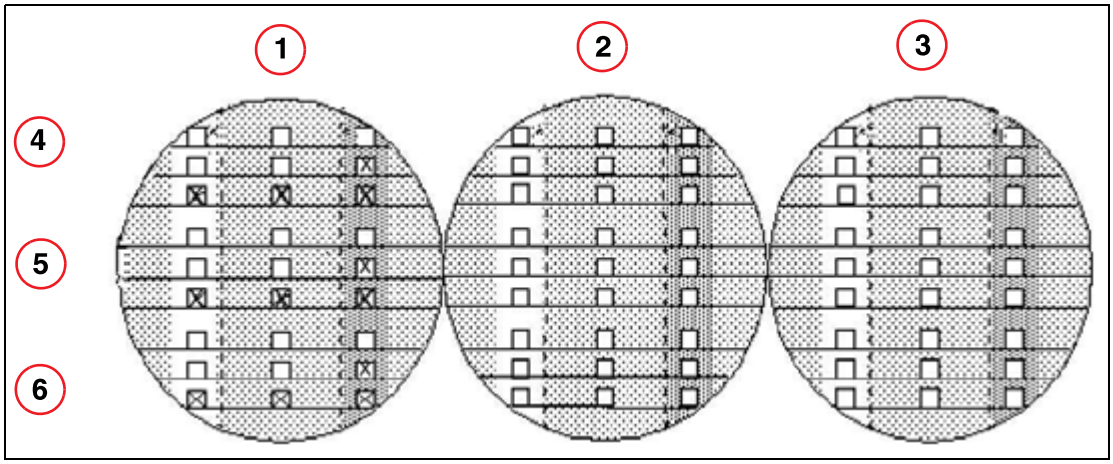

Fig. 7: Monitor image

Pos. 1 Target value
Pos. 2 Factory
Pos. 3 Place of use
Pos. 4 Group 3-mm wide
Pos. 5 Group 2-mm wide
Pos. 6 Group 1-mm wide

- Evaluation of the monitor image

- Unidentified plexi capillaries must be recognizable (Fig. 7 / p. 26).
- Check off the non-visible plexi capillaries in the table of actual values (Fig. 7 / p. 26).

Plexi capillary setpoints

- Unidentified plexi capillaries must be recognizable (Fig. 7 / p. 26).
- Check off the non-visible plexi capillaries in the table of actual values (Fig. 7 / p. 26).

Subtraction mode

Measuring setup

- Attach the dynamic test without holder but with heart contour diaphragm and plexi capillary test right in front of the I.I. input (plexi capillaries close to I.I.). The image field must be completely covered; collimate if necessary.

Requirements

- Select vascular application.
- Select hip (body region).
- Select subtraction.
- Select medium dose.
- Select full format.

Use

- Trigger a scene (radiation on).
- After ≥ 3 seconds, the mask is set automatically. Then cause the plexi capillary test to move by pressing the rubber ball.
- After another 3 seconds, switch the radiation off.
- Select viewer and then select LUT SUB 3 (display on monitor).

  ➪ Do not select any edge enhancement.
- Then, using the mouse in the scroll bar in the Viewer, select the image (scroll 2-3 images back) in which the white and black capillaries are visible most clearly.

Evaluation 1

- On monitor A, determine the capillary lines visible in the individual matrix fields separately for black and white. Enter the result in table (Fig. 8 / p. 28) and table (Fig. 9 / p. 28); mark any non-visible lines with an x.

NOTE	**Do not evaluate the first white line. Start the evaluation with the first black line.**

Black lines

	Setpoints			Factory			Place of use			
	2L	1	5R	2L	1	5R	2L	1	5R	Group
Black										top group 3 mm width
Black			X							
Black	X	X	X							
Black										middle group 2 mm width
Black			X							
Black	X	X	X							
Black										bottom group 1 mm width
Black			X							
Black	X	X	X							

Fig. 8: Operating mode Subtraction_black lines_tab

White lines

	Setpoints			Factory			Place of use			
	2L	1	5R	2L	1	5R	2L	1	5R	Group
White										top group 3 mm width
White			X							
White	X	X	X							
White										middle group 2 mm width
White		X	X							
White	X	X	X							
White										bottom group 1 mm width
White		X	X							
White	X	X	X							

*Fig. 9: Operating mode Subtraction_white lines_tab_*

Evaluation 2

- On monitor A, evaluate the white, 3-mm capillary line in fields 2L, 1 and 5R. There may not be any noticeable difference in brightness in the fields.

No noticeable difference in brightness visible in fields 2L, 1 and 5R:	**Factory**		**Place of use**	
	❑Yes	❑ No	❑Yes	❑ No

Roadmap mode

Measuring setup

- Attach the dynamic test without holder but with heart contour diaphragm and plexi capillary test right in front of the I.I. input (plexi capillaries close to I.I.) and select the distance such that the image field is completely covered.

Requirements

- Select full format.
- No edge enhancement.
- Select vascular application.
- Select hip (body region).
- Select medium dose.
- Select roadmap.
- Select LUT SUB 3 (presetting) (display on monitor).

Use

- Trigger a scene (radiation on; phase 1).
- After ≥ 3 seconds, the mask is set automatically.
- Do not move the plexi capillaries. (Radiation remains on; phase 2)
- After another 3 seconds, switch the radiation off.
- Switch radiation on again (phase 3).
- Cause the plexi capillary test to move by pressing the rubber ball.
- After another 3 seconds, switch the radiation off.
- Save the image (by pressing on the handheld control).
- Then, using the mouse in the scroll bar in the Viewer, select the image (scroll 2-3 images back) in which the white and black capillaries are visible most clearly.

Evaluation

- On monitor A, determine the capillary lines visible in the individual matrix fields separately for black and white.
- Enter the result in table (Fig. 10 / p. 30) and table (Fig. 11 / p. 30); mark any non-visible lines with an x.

NOTE

Do not evaluate the first white line. Start the evaluation with the first black line.

Black lines

	Setpoints			Factory			Place of use			
	2L	1	5R	2L	1	5R	2L	1	5R	Group
Black										top group 3 mm width
Black		X	X							
Black	X	X	X							
Black										middle group 2 mm width
Black		X	X							
Black	X	X	X							
Black										bottom group 1 mm width
Black		X	X							
Black	X	X	X							

Fig. 10: Operating mode Roadmap_black lines_tab

White lines

	Setpoints			Factory			Place of use			
	2L	1	5R	2L	1	5R	2L	1	5R	Group
White										top group 3 mm width
White		X	X							
White	X	X	X							
White										middle group 2 mm width
White		X	X							
White	X	X	X							
White										bottom group 1 mm width
White		X	X							
White	X	X	X							

Fig. 11: Operating mode Roadmap_white lines_tab

Tolerance value: ± 15%

Pixelshift function

Prerequisite:

The subtraction image from the roadmap test is available.

- Select the roadmap image in the Viewer.
- Select pixelshift in the SUB task card.

- Using the arrow tool, move the mask successively in all directions:
  - Apart from the black and white edge strips, no artifacts may occur.
- Using the Auto Pixelshift tool, select a location:
  - In this location the shifted mask must return to artifact-free superimposition.

	Factory				Place of use				
Pixelshift function ok?	❒	Yes	❒	No		❒	Yes	❒	No

Edge enhancement, contrast enhancement and object movements

Requirements

- Place the dynamic test without holder but with heart contour diaphragm and plexi capillary test on the table, see chapter 4, figure 1.
- Select organ program ortho, hip. Medium dose.
- Set the monitor contrast to linear.
- Edge enhancement = (off) (minimum is 10%).

Edge enhancement

- Release fluoroscopy briefly.
- Assessment of the edge enhancement in the LIH image.

Press the button for edge enhancement on the control panel. This successively selects the individual edge enhancement levels (20% or 40%).

Evaluation of the monitor image

	Factory				Place of use				
Edge enhancement function OK? => The bright-dark transitions become clearer when reselecting edge enhancement.	❒	Yes	❒	No		❒	Yes	❒	No

LUT selection change

- Release fluoroscopy briefly.
- Press the key for LUT selection change; the contrast of the image changes.

Evaluation of the monitor image

	Factory				Place of use				
LUT selection change function OK?	❒	Yes	❒	No		❒	Yes	❒	No

Motion unsharpness

- Select organ program (ortho, hip, medium dose).
- Use a stand to place the dynamic test without holder but with heart contour diaphragm and plexi capillary test in the beam path close to the I.I.

- In addition, place a screwdriver centrally on the dynamic test.
- Radiation on.
- With the radiation switched on, move the C-arm slightly in the horizontal direction. The screwdriver creates a smearing effect on the monitor.
- Radiation off.

- Select pulsed fluoroscopy max. pulse frequency organ program (ortho, hip, test).
- Radiation on.
- With radiation switched on, move the C-arm slightly in the horizontal direction. The screwdriver is displayed multiple times and with high definition.
- Radiation "off".
- Remove the stand with the dynamic test from the beam path.

Evaluation of the monitor image

	Factory				Place of use				
FLUORO, pulsed FLUORO functions OK?	❒	Yes	❒	No		❒	Yes	❒	No

Comments

_____
_____
_____
_____
_____

NOTE	**Perform only in the factory.**

	TV iris diaphragm control	With approx. 9-11 mm Cu and dynamic test in the beam path

The following controls are active in the case of the indicated prefiltrations. The test checks the function of these controls.

Requirements

- Both monitors must be set to approximately the same brightness and contrast impression (synchronism) (LUT, brightness and contrast setting).

Preparations

- Attach the dynamic test to the image intensifier:
  - Without holder
  - With heart contour diaphragm
  - Without plexi capillary test
- Select fluoroscopy program (ortho, hip, medium dose).
- Set the edge enhancement to maximum perceptibility of bright/dark transitions.
- Switch the I.I. to full format.
- Completely open the collimator.
- Prefilter with Cu until 120 kV to 124 kV are displayed. To do this, switch on fluoroscopy briefly (required in approx. 9-11 mm Cu).

- Radiation on.
- Evaluate the brightness of the fluoroscopy image. Select LUT 10 or LUT G1.
- Radiation off.
- Store the LIH image and display it on the reference monitor.

TV iris diaphragm control

- Additionally attach 2.1 mm Cu to the radiation exit.
- Radiation on; the generator limit of 125 kV/4.3 mA must be reached.
- Store the LIH image as a reference image.
- Radiation off.
- Store the image and display it in the viewer.
- Assess the brightness of the fluoroscopic image.

The brightness impression with approx. 10mm Cu prefiltration and dynamic test should be approximately the same as the brightness impression with approx. 12.1 mm Cu and dynamic test.

Evaluation

	Factory	
Same brightness impression	❑Yes	❑ No

Checking camera rotation

Prerequisites same as for the Auto Gamma check.

- Edge enhancement on.
- Set the following angles and record an image for each angle.
- Then evaluate the images for artifacts in the viewer.

Angles to be set (to be set on the C-arm control panel):

1°; 2°; 5°; 22°; 85°; 88°; 89°; 90°; 180°; 270°

- **Evaluation:**

Rotation function OK?	❑Yes	❑ No

Vignetting compensation

NOTE	**Perform only in the factory.**

- Remove the dynamic test.
- Select organ program general, hip, standard dose.
- Attach a 2.1 mm Cu prefilter close to the generator.
- Check the optical impression for uniform brightness across the entire image area.
- Using the service tool, the edge brightness decrease can be assessed according to the following example.

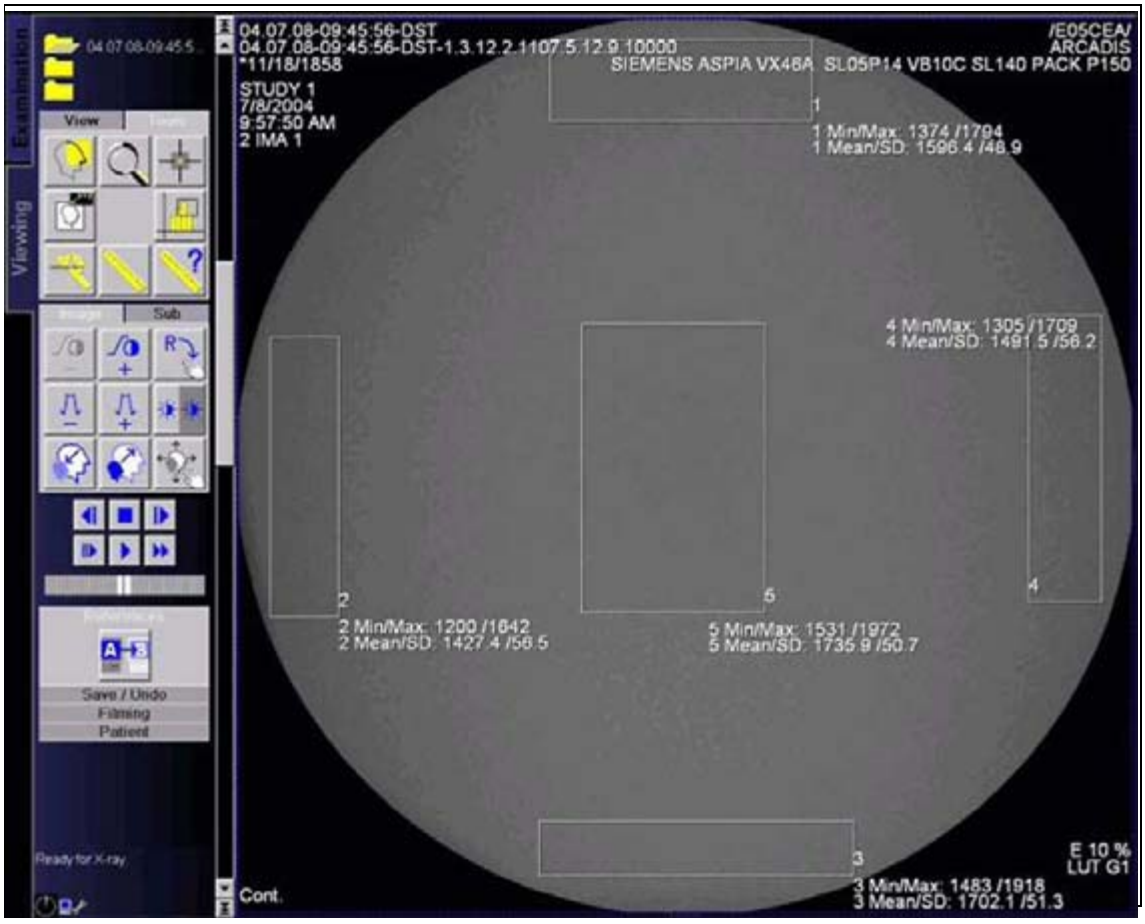

Fig. 12: Measuring field

The average value in the measuring fields at the edge are compared to the value in the middle.

- Evaluation (only for observation).

  Brightness in percentage of the middle measuring field.

  Left.....%; Right.....%; Top.....%; Bottom.....%.

Image disturbances (artifacts)

- Check off all image disturbances determined during settings and IQ tests in the table in the IQ measuring protocol.
- If image disturbances are detected that are not listed in the table, describe them under "Other disturbances".
- Three assessment numbers indicating the extent of the disturbance are provided for each assessment of the relevant disturbance.

Definition of the assessment numbers

1 = No disturbances and artifacts were detected during start-up.

2 = Minor disturbances, artifacts occurred sporadically during start-up. The cause could not be localized and the "error" could not be corrected. The disturbances scarcely affect the good overall image impression, and the ability to make a medical diagnosis from the images is absolutely not impaired. Therefore, the artifacts are tolerable.

3 = During start-up, more frequent or stronger disturbances/artifacts occurred that disturb the overall impression of the image or impair the ability of the images to be diagnosed medically and are therefore no longer tolerable. The system must not be shipped or handed over to the operator in this condition.

Description of the artifacts

- **Hum:**

  Inconsistencies resulting from electromagnetic interference in the imaging systems are unattractive and disturbing. Depending on the nature of the disturbance, they can considerably impair the ability of the images to be evaluated and should ideally not occur at all. They are tolerable only to a very slight degree. Hum disturbances are visible as sporadic, horizontal light-dark patterns in the image; they are temporary and are not limited to a specific location.

- **Interference stripes:**

  Very high-frequency electromagnetic radiation is visible in the image as light or dark, sometimes very short, horizontal lines (temporary). Interference stripes that are caused by dirt on optically effective surfaces must also be recorded here. They are limited to a specific location and are not temporary. Interference stripes are barely tolerable.

- **Ghost images:**

  These are object contours that are usually offset to one side and appear double. They are caused by reflections in poorly adapted, long video cables. Clearly visible ghost images are not tolerable.

- **Background structures** are permanent, grid-shaped patterns, primarily in dark image sections, that are also called "fixed noise".

- **Pixel errors** are image pixels without image information. They are visible on the monitor as dark or light pixel-size dots. There are tolerable and intolerable pixel errors. The TV camera is inspected very precisely in the test area for pixel errors and only TV cameras with pixel errors corresponding to an internal specification according to type and number are provided to customers. These tolerable pixel errors must be documented in the IQ measuring protocol.

Evaluation of the image disturbances

Setpoint for assessment of the disturbance: Only 1 and 2 are allowed.

	Factory			Place of use		
Nature of the disturbance, artifact	**Assessment of the disturbance *1**			**Assessment of the disturbance *1**		
	1	2	3	1	2	3
Hum						
Interference stripes						
Ghost images (reflections)						
Background structures						
Pixel errors ***2**						

Other disturbances:

_____
_____
_____

Comments:

_____
_____
_____
_____
_____

Remark: Image disturbance assessments must be recorded at the place of use.

***1** Assessment of the disturbances

1 = No disturbances, artifacts

2 = Slight disturbances, artifacts

3 = Intolerable disturbances, artifacts

***2** State the number and position of pixel errors under Remarks.

Camera/printer

Camera/printer available? If yes: camera type ..... If no: chapter not applicable.	❑Yes	❑ No

NOTE	**See also General Hardcopy Information, SPR2-330.814.25.01.02 (CB-DOC).**

Function check

- The function check must be performed with all possible image segmentations, in each case with positive and negative image display. Definition: Positive image display means that the hardcopy image is identical to the monitor display.

Requirements

- Select the stored SMPTE test pattern in the viewer.
- Comply with a 20-minute camera warm-up phase.
- Select the image segmentation to be tested in each case.
- Select the image display (positive/negative) to be tested in each case.
- Enter the film type and emulsion number used.

NOTE	**Necessary only for wet film cameras.**

Evaluation

- Measure the exposed film with the densitometer.
- Enter the measured film density values in the following table.
- Record the setting values after the function check.
- Groups of fine lines are displayed in the image center.
  - See SMPTE Fig. 1, chapters 1-5.

	Place of use	
Test OK?	❑ Yes	❑ No

Remarks:

_____

_____

_____

_____

	Film density				
Segmentation	**Gray-scale levels SMPTE**	**Film density *2 SET-POINT (start-up)**	**Film density SET-POINT (maintenance)**	**Film density ACTUAL (start-up)**	**Film density ACTUAL (maintenance)**
Full screen *1 Negative image display (bones white)	0% 40% 100%	< 0.25 1.0 + 0.15 > 2.7	< = 0.27 1.0 + 0.2 > = 2.5		
Full screen Positive image display (bones black)	0% 40% 100%	> 2.7 1.2 + 0.15 < 0.25	> = 2.5 1.2 + 0.2 < = 0.27		
Fourfold *1 Negative image display (bones white)	0% 40% 100%	< 0.25 1.0 + 0.15 > 2.7	< = 0.27 1.0 + 0.2 > = 2.5		
Fourfold Positive image display (bones black)	0% 40% 100%	> 2.7 1.2 + 0.15 < 0.25	> = 2.5 1.2 + 0.2 < = 0.27		
____fold *1 Negative image display (bones white)	0% 40% 100%	< 0.25 1.0 + 0.15 > 2.7	< = 0.27 1.0 + 0.2 > = 2.5		
___fold Negative image display (bones black)	0% 40% 100%	> 2.7 1.2 + 0.15 < 0.25	> = 2.5 1.2 + 0.2 < = 0.27		

n.a., first version